carolina farm stewardship association

This is an **example of a Conservation Planning Activity (CPA 138) report** that you will receive from your CFSA Technical Service Provider.

It includes:

- A discussion of your farm's objectives.
- A whole-farm resource assessment and identification of resource concerns.
- Selection of best conservation practice options for addressing resource concerns.
- A summary of the impacts of potential conservation practices on soil erosion and quality.
- The nuts and bolts of your Organic System Plan (OSP) as defined in the USDA National Organic Program (NOP) Standards.

In this example, you will find the components of the plan, which include:

- **Sample Plan Cover Page**, which contains personal information about the farm, NRCS contract, technical service provider, and the overall goal of the conservation plan. It lists the major practices being proposed and the resulting outcomes.
- **Sample Plan Resource Inventory**, which addresses any resource concerns on the farm in the following areas: Soil. Water, Air, Plant, Animal, Human, and Energy. The Technical Service Provider (TSP, person writing this plan) will visit the farm and work with the grower to identify natural resource areas of concern and corresponding NRCS-funded practices to correct those concerns.
- **Web Soil Survey**, which is a comprehensive overview of the soil types on the farm. It includes a map of the soils in the area and gives information pertaining to the parent material, soil texture, slope, soil profile, depth to bedrock, precipitation, average temperatures, frost-free days, and much more.
- **Custom Site Map**, which highlights the areas of resource concern and will detail where NRCS practices will be implemented. The map may also contain useful information for growers like field width and lengths, borders, riparian areas, water features, structures, wells, irrigation pipelines, fences and other features that can assist landowners in planning and decision-making.
- **Sample Plan Cover Crop Practice Guidelines**, which explain in detail what a proposed NRCS conservation practice entails. For example, the cover cropping job sheet will explain what cover cropping is, what and how it addresses a resource concern, it may give examples of certain cover crops and strategies for their establishment, management and termination and list other NRCS practices that can be used to enhance and improve the proposed practice. This is the most relevant information for a grower to understand about the activities that they are agreeing to carry out.
- **Sample Plan Rusle Report**, which is a soil health management software used by TSPs to determine the soil health impact of differing production techniques. The TSP will use this system to evaluate your current management (Benchmark Scenario) with the unaddressed resource concern, against the implementation of the NRCS conservation practice (Planned Scenario) to determine what changes to management will result in the desired outcome of increasing soil organic matter and limiting soil disturbance. This is accomplished through data analysis of field operations throughout the season and results in SCI and STIR ratings from NRCS that must improve from the benchmark to the planned scenarios and meet required NRCS parameters.
- **Sample Organic Systems Plan (OSP)**, which outlines organic production on your farm and is the backbone of what you will submit to certifying agencies. The Organic Systems Plan (OSP) is effectively a set of standard operating procedures that explain how you manage your farm in accordance with USDA Organic requirements. This document is not only necessary for USDA Organic certification but can be useful in creating standard operating procedures for your operation.
- **Informative charts**, tables and graphs are included in your CPA 138 that can help inform growers of alternative production practices and enable them to make better management decisions. Examples included in this sample plan are for cover crop establishment.

If you have any questions, please contact us at info@carolinafarmstewards.org.

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Conservation Planning Activity (CPA 138)
Supporting Organic Transition

SAMPLE FARM

September 2023

by
Joe Rowland, CFSA Technical Service Provider

www.carolinafarmstewards.org

The cover page contains information about the farm, NRCS contract #, technical service provider, and the overall goal of the conservation plan. It lists the major practices being proposed and the resulting outcomes.

1. COVER PAGE

a. CPA Information

CPA Name (Number)	Supporting Organic Transition (138)
Land Use(s)	Annual crops: Mixed vegetable crops

b. Client Information

Client Name	Sample Farm
Contract Number	xxx
Farm, Tract & Field Numbers	xxx

c. Client Objectives

1. Organic Transition
2. Address soil erosion and soil organic matter depletion that results tillage between crops and mechanical weed control; improve crop health by improving weed control.

d. TSP Information

Name	Joe Rowland
Address	PO Box 448, Pittsboro, NC 27312
Phone Number	919-542-2402
Email	joe@carolinafarmstewards.org
TSP Number	12-*****
County of Service	Cabarrus Co., North Carolina

e. Statements and Signatures

I (Joe Rowland, TSP) certify the work completed and delivered for this CPA:

1. Complies with all applicable federal, state, tribal, and local laws and regulations.
2. The planned practices are based on NRCS Conservation Practice Standards (CPSs) in the state Field Office Technical Guide where the practices are to be implemented.
3. Is consistent with and meets the conservation goals and objectives for which the program contract was entered into by the participant.
4. Incorporates alternatives that are both cost-effective and appropriate to address the resource issue(s) and participant's objective(s).

TSP Signature: _____ Date: 8/30/23

I (Farmer Name) accept the completed CPA deliverables as thorough and satisfying my objectives.

Client Signature: _____ Date: _____

NRCS Signature: _____ Date: _____

NRCS Title: _____

*The **Resource Inventory** portion of the CPA 138 addresses any resource concerns on the farm in the following areas: Soil. Water, Air, Plant, Animal, Human, and Energy. The Technical Service Provider (TSP, person writing this plan) will visit the farm and work with the grower to identify natural resource areas of concern and corresponding NRCS funded practices to correct those concerns.*

1. Natural Resource Inventory & Conservation Planning Process

General farm description:

Sample Farm is a small-scale vegetable farm situated on approximately 5 acres in North Carolina that uses organic practices and is seeking organic certification. Production takes place in both the field and high tunnel.

Previously installed or implemented conservation practices:

None known.

Equipment, technology & management practices:

Management practices: the producer is transitioning Field 5 (Tract 12275; approx. .30 ac.) to certified organic production, and therefore all management must comply with organic regulations. Production relies heavily on hand labor but also uses a small tractor for larger tasks.

The **Benchmark Scenario**, used as a reference point of comparison throughout this document, is cropland in transition to "traditional" organic production that relies heavily on tillage to manage weeds, incorporate crop residues and fertility products, and prepare seedbeds. The **Planned Scenario** is a reduced tillage organic production system (sometimes referred to as "rotational organic no-till") that uses high-biomass cover crops to suppress weeds and enables no-till production. Equipment used in **Benchmark** and **Planned Scenarios** is similar – the same planting and harvesting equipment, as well as much of the same tillage and cultivation equipment, although tillage and cultivation equipment are used less in the Planned Scenario. The most important distinction between the Benchmark and Planned Scenarios is the use of two 'new' pieces of equipment under the Planned Scenario: a roller-crimper (or flail mower). The roller crimper (or flail mower) is used to terminate the high-biomass cover crops, which are grown to create a weed-suppressing mulch upon crimping (or mowing), and enable no-till establishment of vegetable crops in late spring. In the Planned Scenario, traditional inter-row cultivation is not used.

Fertility products used are minimal and approved for use in organic production. Legume cover crops will be used in the Planned Scenario to improve nitrogen supply to subsequent crops. Cover crop species include crimson clover (paired with cereal rye), which are fall-planted and precede summer crops.

Soils, climate & topography:

The soils in the planning area are primarily Appling fine sandy loam (85%), Worsham (3%).

Absolute slopes in the planning area are 2% to 6% (72' to 110' critical lengths). Slopes in the direction of crop rows are 72 to 110 critical lengths. North Carolina receives 42" annual rainfall. Average highs during the warmest months of the year (June - Aug) are 86°F, and 46°F during the coolest months of the year (Dec - Feb). Average low during the winter months is 27°F and 67°F for the warmer months. This location is classified as winter hardiness zone 7a: average annual extreme minimum temperature is 0° to 10°F.

Environmentally sensitive areas in the planning area:

None known (see next about HEL designation)

Compliance with Highly Erodible Land (HEL) or Wetland determinations:

Not known

Federal, State, Tribal and Local Laws, Regulations, Policies and Their Associate Permit Requirements:

No knowledge of noncompliance.

Natural Resource Inventory:

Soil

i. *Gully erosion (classic & ephemeral): Gullies are created by the concentrated flow of water, generally in well-defined drainage ways. Classic gullies are larger and more permanent than ephemeral gullies; ephemeral gullies can be obscured by tillage, for example, whereas classic gullies cannot.* ***STATUS: No resource concern observed****.*

ii. *Sheet & rill erosion: Less dramatic forms of erosion compared to gully erosion, sheet and rill-type erosion remove smaller amounts of soil more uniformly across a field. Rills are small channels (typically ranging from <1" wide and deep to several inches wide and deep).* ***STATUS: YES, resource concern observed.***

iii. *Subsidence: The loss of soil volume or depth due to the oxidation (i.e. degradation) of soil organic matter. This typically happens in soils that have a high proportion of organic matter. Generally, such soils are not present on farmland in the Southeastern U.S.* ***STATUS: No resource concern observed.***

iv. *Wind erosion: Removal of soil particles by wind instead of water.* ***STATUS: No resource concern observed****.*

v. *Aggregate instability (lack of soil structure): Soil structure (aggregation) is the extent to which soil particles are held together by roots and fungal hyphae, organic matter, and charges on clays and organic matter, and is negatively affected by tillage due to physical disturbance and the resulting organic matter breakdown. Symptoms include surface crusting, surface ponding, limited water-holding capacity, and platy or blocky surface soil texture.* ***STATUS: No resource concern observed (no surface crusting or ponding, or platy/blocky soil texture).*** *Conditions during site visit were dry, however, when visual assessment of aggregate instability is not ideal.*

vi. *Compaction: Soil compaction is the physical process of reducing micro- and macroscopic spaces between soil particles and aggregates (pores), leading to reductions in root ingrowth, water infiltration and drainage, and water-holding capacity. Compaction typically results from compression events when the soil is wet; compression events can be from the tires of farm equipment, livestock hooves, or human feet, but also repeated physical disturbance*

from tillage. ***STATUS: No resource concern observed (no evidence such as ponding, stunted plant growth, or root growth limitation).***

vii. *Organic matter depletion: The balance of organic matter in soil is determined by 1) organic matter additions from living plants and other organisms (internal inputs), as well as from added organic matter from manure and mulches (external inputs), vs. 2) the natural process of of organic matter breakdown by soil microorganisms. Tillage and other forms of soil disturbance encourage the breakdown of organic matter by these microorganisms. In order to maintain or increase soil organic matter, the losses from decomposition must be made up for with additions from internal and external inputs.* ***STATUS: Yes, resource concern observed.***

viii. *Salts and other chemicals: Soil salinity results from the accumulation of water-soluble salts in soil, most often in drier areas where the loss of water from soil (from evaporation and evapotranspiration) exceeds precipitation. Saline soils are uncommon in the Southeastern U.S. Saline soils and high concentrations of other chemicals decrease plant productivity and soil function.* ***STATUS: No resource concern observed.***

ix. *Soil organism habitat loss or degradation: Habitat for soil organisms is simply the array of macro- and microscopic spaces between soil particles and/or within aggregates. Generally, the food source for the soil foodweb is organic matter, although a multitude of soil microorganisms are fed directly by plants via symbiotic relationships. The loss or degradation of this habitat happens when the soil is disturbed and/or the food supplied (again, in the form of organic matter) is inadequate to maintain the amount or diversity of microorganisms in soil. Thus, minimizing soil disturbance and maximizing plant coverage, biomass and diversity are essential for maintaining soil organism habitat at its best.* ***STATUS: No resource concern observed.***

Water

i. *Drifted Snow: Wind-blown snow accumulates around and over surface structures, which restricts access to humans or animals; or wind removes snow from desired location where it can be used to accumulate water.* ***STATUS: No resource concern observed.***

ii. *Ponding and Flooding: Water covering the land surface, along with saturated conditions below the surface, degrades natural resources, or restricts capability of land to support its intended use.* ***STATUS: No resource concern observed.***

iii. *Seasonal High Water Table: Ground water or a perched water table causing saturated conditions near the surface degrades water resources or restricts capability of land to support its intended use.* ***STATUS: No resource concern observed.***

iv. *Seeps: Sub-surface saturated flows that percolate slowly to the surface, degrades water resources, or restricts capability of land to support its intended use.* ***STATUS: No resource concern observed.***

v. *Groundwater Depletion: Underground water is used at a rate greater than aquifer recharge.* ***STATUS: No resource concern observed.***

vi. *Surface Water Depletion: Water from collected precipitation runoff, ponds, lakes, surface watercourses and reservoirs is used at a rate that is detrimental to ecological functions or other identified uses and threatens sustained availability of surface water.* ***STATUS: N/A: surface water is not used for irrigation.***

vii. *Inefficient Irrigation Water Use: Irrigation water is not stored, delivered, scheduled, and/or applied efficiently.* ***STATUS: No resource concern observed.***

viii. *Naturally Available Moisture Use: Natural precipitation is not optimally managed to support desired land use goals or ecological processes.* ***STATUS: No resource concern observed.***

ix. *Nutrients to Surface or Groundwater: Nutrients (organic and inorganic) stored, concentrated, or applied are transported to receiving surface waters or groundwater in quantities that degrade water quality and limit its use for intended purposes.* ***STATUS: No resource concern observed. Nutrient concentrations in organic fertility products are generally low, and are not considered to be a leaching or surface water threat.***

x. *Pathogens and Chemicals to Surface or Groundwater: Pathogens, pharmaceuticals, leachate, and chemicals from manure, biosolids or compost transported to receiving surface waters and groundwater in quantities that degrade water quality and limit uses.* ***STATUS: No resource concern observed; manure is incorporated immediately after application to reduce potential transport to waterways.***

xi. *Pesticides to Surface or Groundwater: Pesticides are lost from their application area and transported to surface water sources and groundwater in quantities that degrade water quality and limit its use for intended purposes.* ***STATUS: No resource concern observed. No pesticides are used on the farm.***

xii. *Pollutants to Surface or Groundwater: Petroleum, heavy metals, and other chemical pollutants for on-farm use are lost from areas of concentration (handling, storage, or processing facilities and areas) to receiving surface waters or groundwater in quantities that degrade water quality and limit its use for intended purposes. This resource concern does not cover pathogens/manure, sediment (although sediment contaminated with petroleum, heavy metals, or other chemical pollutants would be covered), nor naturally occurring salts.* ***STATUS: No resource concern observed. Handling, storage and processing facilities for potential pollutants are not present on the farm.***

xiii. *Salts to Surface or Groundwater: Irrigation or rainfall runoff transports salts to receiving surface waters and groundwater in quantities that degrade water quality and limit use for intended purposes.* ***STATUS: No resource concern observed.***

xiv. *Sediment to Surface Water: Offsite transport of sediment to surface water degrades water quality and limits use for intended purposes.* ***STATUS: No resource concern observed.***

xv. *Elevated Water Temperature: Surface water temperatures exceed State/Federal standards in downstream receiving waters which limits its use for intended purposes.* ***STATUS: No resource concern observed.***

Air

i. *Emissions of Airborne Reactive Nitrogen: Emissions of airborne reactive nitrogen—ammonia and oxides of nitrogen—can negatively impact atmospheric chemistry, cause unwanted fertilization via deposition in sensitive ecosystems, and degrade regional visibility.* ***STATUS: No resource concern observed or expected.***

1. *Engine exhaust: Diesel engine(s) used to date are modern and meet EPA Tier 3 standards, to the best of the TSP's knowledge.*
2. *Open burning: No open burning.*
3. *Nitrogen fertilizer:* ***Feather Meal is incorporated into soil immediately after application to minimize ammonia and NO_x losses to the atmosphere.***
4. *Livestock: No livestock present.*

ii. *Emissions of Greenhouse Gases: Emissions of methane (CH_4), nitrous oxide (N_2O), and carbon dioxide (CO_2) increase atmospheric concentrations of greenhouse gasses.* ***STATUS: Yes, possible resource concern observed or expected.***

1. *Nitrogen fertilizer: Concentrated forms of urea are not used on the farm, minimizing microbial N_2O production.*
2. *Carbon stocks: CO_2 emissions from soil may be relatively high following intensive tillage, and therefore may be a resource concern. However, it is difficult to identify soil organic matter equilibrium without further testing, and CO_2 emissions from soil may not be elevated; this resource concern lacks a quantitative target and measurement method.*
3. *Methane from livestock: No livestock present.*

iii. *Objectionable Odors: Emissions of odorous compounds—volatile organic compounds (VOCs), ammonia, and odorous sulfur compounds—can cause nuisance conditions.* ***STATUS: No resource concern observed***

1. *Livestock: No livestock present.*

iv. *Emissions of Ozone Precursors: Emissions of ozone precursors—oxides of nitrogen (NOx) and volatile organic compounds (VOCs)—result in formation of ground-level ozone, which can*

have negative impacts to human, plant, and animal health. ***STATUS: No resource concern observed***

1. *Engine exhaust: Diesel engine(s) used are modern and meet EPA Tier 3 standards, to the best of the TSP's knowledge.*
2. *Open burning: No open burning.*
3. *Pesticide VOCs: No pesticides used.*
4. *Livestock: No livestock present.*

v. *Emissions of Particulate Matter and Particulate Matter Precursors: Direct emissions of particulate matter (PM)—dust and smoke—as well as the formation of fine particulate matter in the atmosphere from other agricultural emissions—ammonia, oxides of nitrogen (NOx), and volatile organic compounds (VOCs)—can cause multiple negative environmental impacts.* ***STATUS: No resource concern observed***

1. *Engine exhaust: Diesel engine(s) used are modern and meet EPA Tier 3 standards, to the best of the TSP's knowledge.*
2. *Open burning: No open burning.*
3. *Pesticide drift: No pesticides used.*
4. *Nitrogen fertilizer:* ***Feather Meal is incorporated into soil immediately after application to minimize PM and PM precursors from nitrogen fertilizers****.*
5. *Dust from fields: No dust or PM issues observed.*
6. *Dust from unpaved roads: Unpaved roads are few and minimally used; no dust or PM issues observed.*
7. *Windblown dust: Field operations and size minimize potential for windblown dust; no windblown dust observed.*
8. *Confinement-based operations: N/A - no livestock are present in operations.*

Plants

i. *Plant Pest Pressure: Excessive damage to plant communities from pests such as undesired plants, insects, diseases, animals, soil borne pathogens, and nematodes. This concern addresses invasive plant, animal and insect species.* ***STATUS: No resource concern observed.***

ii. *Productivity and Health: Improper fertility, management, or plants not adapted to site negatively impact plant productivity, vigor, and/or quality.* ***STATUS: No resource concern observed.***

iii. *Structure and Composition: Plant communities have insufficient composition and structure to achieve ecological functions and management objectives. This resource concern includes degradation of wetland habitat, targeted ecosystems, or unique plant communities.* ***STATUS: No resource concern observed.***

iv. *Wildfire Hazard from Biomass Accumulation: The kinds and amounts of plant biomass create wildfire hazards that pose risks to human safety, structures, plants, animals, and air resources.* ***STATUS: No resource concern observed.***

Animals

i. *Aquatic Habitat for Fish and Other Organisms: Habitat requirements of identified fish and other organisms are inadequate.* ***STATUS: No concerns*** *- Aquatic habitat is not impacted by farming operations.*

ii. *Terrestrial Habitat for Wildlife and Invertebrates: Quantity, quality or connectivity of food, cover, space, shelter, and/or water is inadequate to meet requirements of identified terrestrial wildlife or invertebrate species.* ***STATUS: No concerns***

iii. *Feed and Forage Imbalance: Feed and forage quality or quantity is inadequate for nutritional needs and production goals of the kinds and classes of livestock.* ***STATUS: N/A*** *- no livestock present.*

iv. *Inadequate Livestock Shelter: Livestock lack adequate shelter from climatic conditions to meet basic needs.* ***STATUS: N/A*** *- no livestock present.*

v. *Inadequate Livestock Water (Quality, Quantity & Distribution): Quantity and quality of drinking water are insufficient to meet basic needs for the kind and class of livestock and improper distribution negatively impacts other resources.* ***STATUS: N/A*** *- no livestock present.*

Energy

i. *Energy Efficiency of Equipment and Facilities: Stationary equipment and facilities are using energy inefficiently.* ***STATUS: No resource concern observed.*** *Energy use appears to have been minimized (cost-effectively).*

ii. *Energy Efficiency of Farming Practices and Field Operations: Mobile on-farm, ranching, forestry, or field operations are using energy inefficiently.* ***STATUS: No resource concern observed.*** *Energy use appears to have been minimized (cost-effectively).*

Human Considerations

i. ***Human Considerations****: Potential societal, economic, and cultural resources and historic property factors under consideration.* ***STATUS: No concerns noted.***

Resource Assessment Tools & Results:

1. *Visual assessments were made for all Resource Concerns described above.*
2. *Input from Client was considered to support visual assessments or where appropriate.*
3. *Soil Erosion Estimation by RUSLE2: Summary is below; printouts follow this report.*

Table 1. *Soil erosion (tons/acre/year) and Soil Conditioning Index (SCI) were estimated using RUSLE2. Percent slope and critical length (ft) used in the analysis - which represent the worst-case scenario - are shown. Red text indicates resource concerns.*

Location	Slope		Soil Type	Erosion (tons/acre/year)		Soil Conditioning Index	
	%	Critical Length		Bench- mark	Planned	Bench-mark	Planned
North Field	2.6	110’	Appling Fine Sandy Loam	13	2.9	-.84	.29
East Field	5.54	72’	Appling Fine Sandy Loam	23	4.9	-1.6	.075
West Field	2.96	100’	Appling Fine Sandy Loam	15	4.7	-.96	.0051
High Tunnel	3.18	90’	Appling Fine Sandy Loam	1.3	.41	.023	.37

See RUSLE2 Output following documentation of the conservation planning process.

Conservation Planning Process

1. ***Identify Problems & Opportunities:*** *On-site assessment concluded that the transition to organic management will require significantly more soil disturbance compared to the conventional (herbicide-based) management that preceded it for many years. The increase in soil disturbance will lead to greater soil erosion and soil organic matter loss. With the development of organic no-till techniques over the last two decades, there is great opportunity to successfully transition to organic grain production without a significant loss of soil or organic matter. This is enabled almost entirely by the use of high biomass cover crops between cash crops.*

2. ***Determine Objectives:***

   On-site assessment and discussion with client identified two main objectives: 1) assist with organic transition, and 2) address soil erosion and soil organic matter depletion that results

tillage between crops and mechanical weed control; improve crop health by improving weed control.

3. ***Inventory Resources:***

   Natural resources are inventoried above. In summary, soil erosion and soil organic matter loss are the identified resource concerns.

4. ***Analyze Resource Data:***

   *Natural resources were analyzed using RUSLE2, visually and through discussion with the Client. See results above, "**Resource Assessment Tools & Results**"*

5. ***Formulate Alternatives:***

   a. *Alternative 1 (No-action alternative): current management activities are continued without intervention or improvement.*

   b. *Alternative 2: Use Cover Crop (340) to implement a high biomass cover crop paired with Mulching (484) to reduce tillage and improve nitrogen supply. High biomass cover crops paired with mulching enable the no-till establishment of vegetable crops in the spring and have season-long weed suppression, thereby eliminating the need for mechanical weed control.*

6. ***Evaluate Alternatives**:*

   a. *Alternative 1 – No-Action Alternative will lead to excessive soil erosion and organic matter loss over time; threatening long-term productivity.*

   b. *Alternative 2: High biomass cover cropping (Cover Crop 340) paired with landscape fabric (Mulching 484):*

      i. *Short-term effects of proposed practices:*

         Proposed low-till production system (Planned Scenario; Alternative 2), in the short-term, will lead to significant reduction in soil erosion and organic matter loss, which has resulted from intensive tillage (Benchmark Scenario). If soil nutrient-building practices are used, this is only a transient effect, and may take 3-5 years to reach a new equilibrium. During that time period, it may help to supplement with organic nitrogen fertilizer. See "Recommendations to avoid or mitigate negative effects on natural resources", below, for more information about nitrogen fertilizers.

      ii. *Long-term effects of proposed practices:*

         Proposed low-till production (Planned Scenario; Alternative 2) over the long-term will reduce soil erosion and organic matter loss significantly (compared to the Benchmark Scenario), and should provide stable yields after soil nutrient and soil microbial communities have reached a new equilibrium. Long-term soil erosion will lead to reduced crop health and yields over time. Consistent yields enable business success through consistent revenue and profit margins.

iii. *Effects on special environmental concerns (from Resource Inventory):*

None known.

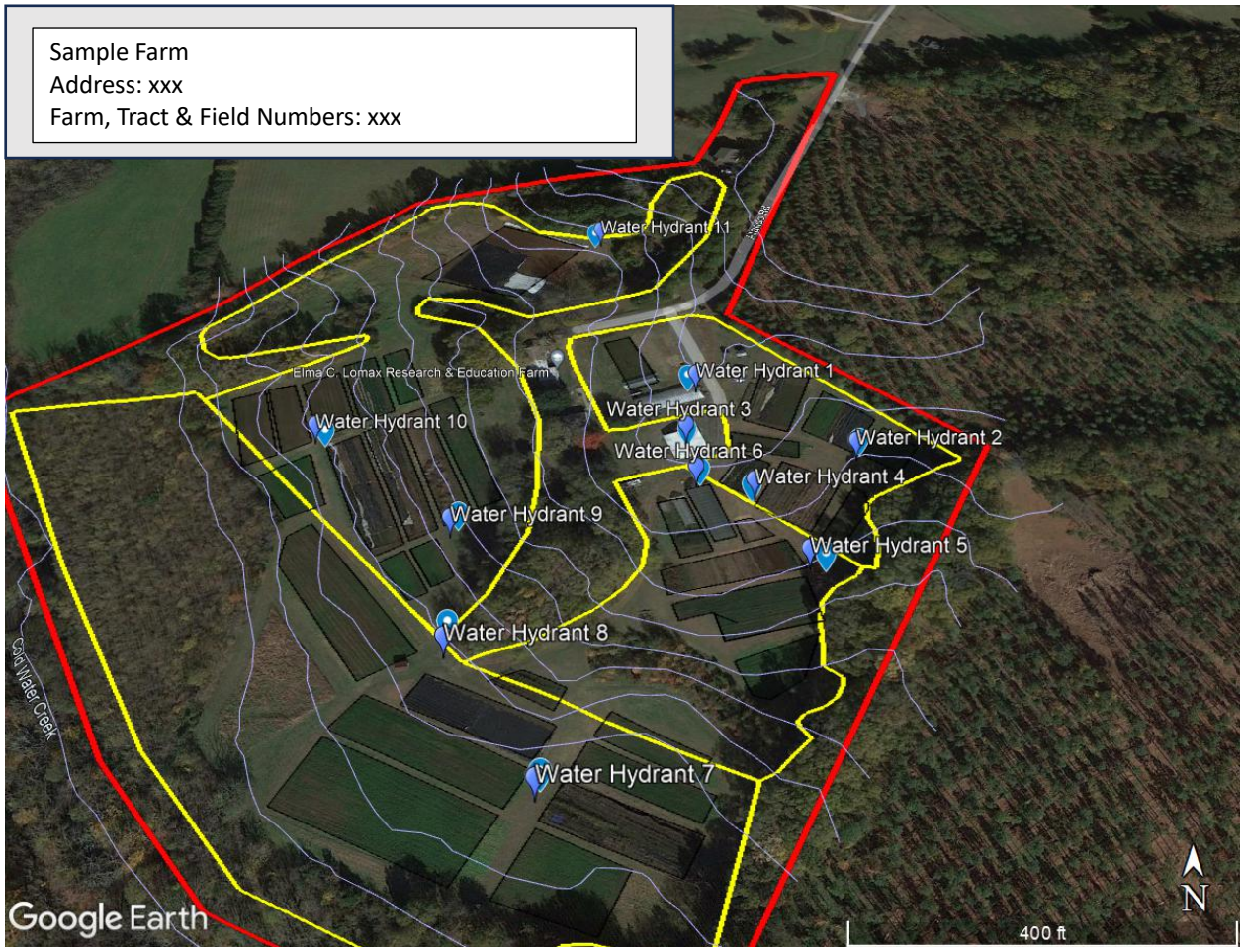
iv. *Recommendations to avoid or mitigate negative effects on natural resources:*

The combination of high biomass cover crops, including a legume to improve nitrogen supply, with a long-lasting mulch such as landscape fabric will help to protect natural resources by ensuring production success, thereby preventing use of intensive tillage for weed and nutrient management. ***The recommended production system is robust and reliable. However, attention should be paid to two management details****:*

- *Cover crops must be at the right growth stage to be terminated mechanically. Because crimson clover is easier to terminate than cereal rye, simply using cereal rye to determine termination timing is adequate.* ***The target growth stages for successful termination is reach late flowering to early seed development of rye****. After the emergence of the rye seed head in the spring, check the rye growth stage weekly until it reaches late flower to early seed development.*
  - *Attempting to terminate earlier may result in failed termination, which will ultimately delay successful termination and therefore delay crop establishment by several weeks.*
  - *Waiting to terminate later will reduce nitrogen available to the subsequent crop and the development of mature seed, which can become weedy that season or the next one.*
- ***Landscape fabric should be applied to cover nearly 100% of the field at crop establishment (seeding or transplanting)****, leaving only enough space between fabric pieces for crops to grow. Less exposed area gives weeds fewer places to grow.*
- *High biomass cover crops, especially those dominated by cereal rye, can make nitrogen less available to the subsequent crop during the first 1-3 years of implementing this practice. Generally, nitrogen supply is greater after this 1-3 year transition period once organic matter increases and the soil microbial community changes accordingly.* ***In order to ensure nitrogen supply to maintain crop yields, there are two considerations:***
  - *First, the use of* ***landscape fabric improves nitrogen supply to crops by speeding up the decomposition of the cover crop*** *residue left on the soil surface. Use of landscape fabric is highly recommended to maintain nitrogen supply to crops when implementing a high-biomass cover crop system.*
  - *Second, if crop performance is lower than expected,* ***consider applying supplemental nitrogen in-crop or before crop establishment****.*

A custom-made map is included with every CPA 138. The map will highlight the areas of resource concern and will detail where NRCS practices will be implemented. The map may also contain useful information for growers like field width and lengths, borders, riparian areas, water features, structures, wells, irrigation pipelines, fences and other features that can assist landowners in planning and decision-making.

Custom Site Map



Practice guidelines, often called Job Sheets, explain in detail what a proposed NRCS conservation practice entails. For example, the cover cropping job sheet will explain what cover cropping is, what and how it addresses a resource concern, it may give examples of certain cover crops and strategies for their establishment, management and termination and list other NRCS practices that can be used to enhance and improve the proposed practice. This is the most relevant information for a grower to understand about the activities that they are agreeing to carry out.

Sample Plan Cover Crop Practice Guidelines

USDA United States Department of Agriculture

Conservation Practice Standard Overview

Cover Crop (340)

Cover crop is growing a crop of grass, small grain, or legumes primarily for seasonal protection and soil improvement.

Practice Information

Cover and green manure crops are grown on land where seasonal or long-term benefits of a cover crop are needed.

This practice is used to control erosion, add fertility and organic material to the soil, improve soil tilth, increase infiltration and aeration of the soil, and improve overall soil health. The practice is also used to increase populations of bees for pollination purposes. Cover and green manure crops have beneficial effects on water quantity and quality. Cover crops have a filtering effect on movement of sediment, pathogens, and dissolved and sediment-attached pollutants.

Operation and maintenance of cover crops include: controlling weeds by mowing or by using other pest management techniques, and managing for the efficient use of soil moisture by selecting water-efficient plant species and terminating the cover crop before excessive transpiration. Use of the cover crop as a green manure crop to cycle nutrients will impact when to terminate the cover to match release of nutrient with uptake by following cash crop.

Common Associated Practices

Cover Crop (340) is commonly applied with practices such as Conservation Crop Rotation (328); Residue and Tillage Management, No Till (329); Residue and Tillage Management, Reduced Till (345); Nutrient Management (590), and Integrated Pest Management (595).

For further information, contact your local NRCS field office.

RUSLE2 is a soil health management software used by TSP's to determine the soil health impact of differing production techniques. The TSP will use this system to evaluate your current management (Benchmark Scenario) with the unaddressed resource concern, against the implementation of the NRCS conservation practice (Planned Scenario) to determine what changes to management will result in the desired outcome of increasing soil organic matter and limiting soil disturbance. This is accomplished through data analysis of field operations throughout the season and results in SCI and STIR ratings from NRCS that must improve from the benchmark to the planned scenarios and meet required NRCS parameters.

USDA NRCS Natural Resources Conservation Service

RUSLE2 Profile Erosion Calculation Record

Info:

File:
Access Group: R2_NRCS_Fld_Office

Inputs:

Location	*Soil*	*Slope length (horiz)*	*Avg. slope steepness, %*
default	default	72	5.5

R Factor	*Annual precip*	*10-yr 24-hr rainfall*	*In Req area?*
200	240	3.0	No

Management	*Vegetation*	*Yield units*	*# yield units, #/ac*
managements\CMZ 66\c.Other Local Mgt Records\	vegetations\Potato, sweet	lbs	22000
managements\CMZ 66\c.Other Local Mgt Records\	vegetations\Clover, annual, fall cover crop, mid Sept seeded	pounds	750
managements\CMZ 66\c.Other Local Mgt Records\	vegetations\Kale	lbs	11000
managements\CMZ 66\c.Other Local Mgt Records\	vegetations\default	Bushels	200
managements\CMZ 66\c.Other Local Mgt Records\	vegetations\Potato, sweet	lbs	22000
managements\CMZ 66\c.Other Local Mgt Records\	vegetations\Rye and Hairy vetch, winter cover, mid south	lbs	5000
managements\CMZ 66\c.Other Local Mgt Records\	vegetations\Collard, greens	lbs	8900
managements\CMZ 66\c.Other Local Mgt Records\	vegetations\Rye, winter cover crop, mid Sept seeding	pounds	6000

Contouring	*Strips/barriers*	*Diversion/terrace, sediment basin*	*Subsurface drainage*	*Adjust res. burial level*	*General yield level*	*Rock cover, %*
a. rows up-and-down hill	(none)	(none)	(none)	Normal res. burial	Management set yield	0

Outputs:

T value	*Soil loss erod. portion*	*Detachment on slope*	*Soil loss for cons. plan*	*Sediment delivery*	*Net C factor*	*Net K factor*	*Crit. slope length*	*Surf. cover after planting, %*
3.0	4.9	4.9	4.9	4.9	0.056	0.70	72	

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
4/1/1	Winter kill annual crop		93
4/1/1	Add mulch		93
4/1/1	Roller, crimp, covercrop		93
4/1/1	Add mulch		93
5/1/1	Planting, manual on 8 inch high beds	Potato, sweet	85
10/1/1	Planting, broadcast seeder	Clover, annual, fall cover crop, mid Sept seeded	61
2/1/2	Add mulch		46
2/1/2	Roller, crimp, covercrop		46
2/1/2	Planter, small veg seed on 8 inch high beds	Kale	46
5/1/2	Harvest, leafy veg.		24
5/1/2	Planting, broadcast seeder		24
5/1/2	Add mulch	Potato, sweet	24
5/1/2	Roller, crimp, covercrop		24
5/1/2	Planting, manual on 8 inch high beds		24
10/1/2	Harvest, hand pick multiple times		21
10/1/2	Planting, broadcast seeder	Rye and Hairy vetch, winter cover, mid south	21
5/1/3	Winter kill annual crop		99
5/1/3	Add mulch		99
5/1/3	Roller, crimp, covercrop		99
5/1/3	Add mulch		99
5/1/3	Planter, small veg seed on 8 inch high beds	Collard, greens	99
8/1/3	Harvest, hand pick multiple times		88
10/1/3	Planting, broadcast seeder	Rye, winter cover crop, mid Sept seeding	73
4/1/4	Winter kill annual crop		97
4/1/4	Add mulch		97
4/1/4	Roller, crimp, covercrop		97
4/1/4	Add mulch		97

FUEL USE EVALUATION:

Fuel type for entire run	*Equiv. diesel use for entire simulation*	*Energy use for entire simulation*	*Fuel cost for entire simulation, US$/ac*
(none)	3.54	491000	0

SCI and STIR Output

Soil conditioning index (SCI)	*SCI OM subfactor*	*SCI FO subfactor*	*SCI ER subfactor*	*Avg. annual slope STIR*	*Wind & irrigation-induced erosion for SCI, t/ac/yr*
0.075	-0.34	0.99	-0.93	1.1	0

The **SCI** is the **Soil Conditioning Index** rating. If the calculated index is a negative value, soil organic matter levels are predicted to decline under that production system. If the index is a positive value, soil organic matter levels are predicted to increase under that system.

The **STIR** value is the **Soil Tillage Intensity Rating**. It utilizes the speed, depth, surface disturbance percent and tillage type parameters to calculate a tillage intensity rating for the system used in growing a crop or a rotation. STIR ratings tend to show the differences in the degree of soil disturbance between systems. The kind, severity and number of ground disturbing passes are evaluated for the entire cropping rotation as shown in the management description.

This conservation plan helps streamline the process of becoming Certified Organic by including an Organic Systems Plan which is required for certification. It outlines organic production on your farm and is the backbone of what you will submit to certifying agencies. The Organic Systems Plan (OSP) is effectively a set of standard operating procedures that explain how you manage your farm in accordance with USDA Organic requirements. This document is not only necessary for USDA Organic certification but can be useful in creating standard operating procedures for your operation.

Sample Organic Systems Plan (OSP)

Last Name(s)	First Name(s)	Farm/Ranch/Business Name	Date
		Sample Farm	

***Crop Production Overview** **7 C.F.R. § 205.2-205.406**

1. ***List all crops (or types of crops if your operation is highly diversified) you grow or harvest for which you are seeking organic certification. Include food and feed crops, pasture/forage, and wild crops.**

   Vegetable production on .3ac consisting of sweet potatoes, spinach, tomatoes, kale and collards in a no till production system.

2. ***Check the box that describes your operation's production systems:**
   ☒ **All organic production** ☐ **Organic and non-organic production**

3. ***Do you grow crops in soil?**
   ☐ **No** ☒ **Yes; please submit the following Crop OSP forms: Crop Rotation and Soil Management; Pest, Disease and Weed Management; Prevention of Contamination and Commingling; Recordkeeping, Labeling and Audit Trail.** ☒ **Attached (4 forms)**

4. ***Do you plant seeds, seedlings, or planting stock of any kind?**
   ☐ **No** ☒ **Yes; please submit the Seeds and Planting Stock form.** ☒ **Attached**

5. ***Do you use any off-farm input materials?**
   ☐ **No** ☒ **Yes; please submit the Materials List form.** ☒ **Attached**

6. ***Do you produce seedlings or crops in containers with planting medium, or grow crops in a greenhouse, cold frame or hoophouse?**
   ☒ **No** ☐ **Yes; please submit the Greenhouse Crop form.** ☐ **Attached**

7. ***Do you produce compost or use purchased compost?**
   ☒ **No** ☐ **Yes**

8. ***Do you use raw manure?**
   ☒ **No (no manure OR manure that has been sanitized by an approved process)** ☐ **Yes**

9. ***If Yes to either question 7 or 8, please submit a Compost and Manure form.** ☒ **Attached**

10. **Do you do any post-harvest handling of your crop products?**
    ☐ **No; skip to question 13.** ☒ **Yes; check all that apply, or describe, as appropriate.**
    ☐ **wash product with water** ☐ **cool product** ☐ **clean product**
    ☐ **sort/size product** ☐ **transport crops** ☐ **bag or package crops**
    ☐ **grade product** ☒ **store product** ☐ **dry product**

11. **If any of the above post-harvest activities are checked, please complete a Crop Post-Harvest Handling OSP to describe the post-harvest handling activities to be certified. ☒ Attached**

12. **Do you perform complex handling of crop products (change their essential form, e.g., cut, cook, etc.)?**
    ☒ No ☐ Yes; list handling/processing activities below, and complete the appropriate Handler OSP Forms to become certified as an Organic Handler. ☐ Attached

Update changes: Signature _____ Date _____

*Seed and Planting Stock 7 C.F.R. § 205.204

***Check all boxes that describe what you use or plan to use:**

1. ***Seeds and Annual Planting Stock**
   - ☐ **not applicable; no seeds or annual planting stock used or planned for use**
   - ☒ **certified organic seed, purchase**
   - ☐ **certified organic seed, saved on farm (requires records)**
   - ☐ **certified organic planting stock (e.g., seed potatoes, sweet potato slips, garlic, strawberry crowns)**
   - ☒ **non-organic, untreated seed**
   - ☐ **non-organic, untreated planting stock for annual crops**

   If non-organic seed or planting stock is used, please complete question 2 below.

2. ***Seed or Planting Stock Treatments and Inoculants**
   - ☐ **not applicable; none used** ☒ **inoculant** ☐ **coating**
   - ☐ **pelletization** ☐ **priming** ☐ **fungicide or insecticide**
   - ☐ **disinfection** ☐ **other (describe): _____**

   Please list specific treatments and inoculants:
   Rhizobium spp. for legumes

3. ***Annual Seedlings**
   - ☒ **not applicable; no annual seedlings grown or purchased**
   - ☐ **seedlings or transplants grown on farm. Please complete the Greenhouse OSP.** ☐ **Attached**
   - ☐ **purchased certified organic seedlings. List supplier and attach organic certificate.** ☐ **Attached**
   - ☐ **other (describe): _____**

4. ***Perennial Planting Stock (for crops grown as perennials, e.g., trees, shrubs, vines)**
   - ☒ **not applicable; no perennial planting stock is used**

5. ***Commercial Availability**
   - ☐ **not applicable; all seed and planting stock is certified organic**

   NOTE—If you use seed or planting stock that is not certified organic, describe how you determine whether an equivalent organic variety is commercially available, and describe any efforts you are making to source more organic seed/planting stock in the future.

   Contact or identify online at least 3 vendors to check for availability; purchase untreated conventional seed if organic options for specific variety is not available

Please have documentation available for inspection that shows the source(s), quantity, variety(ies) and organic status of seed and/or planting stock used, whether purchased or produced on the farm. If non-organic seed or planting stock is used, provide documentation of your search for equivalent varieties of organic seed or planting stock and reasons for commercial non-availability.

Update changes: Signature _____ Date _____

***Soil Management and Crop Rotation** **7 C.F.R. §§ 205.2, 205.203, 205.205**

1. ***What are the major practice components of your soil-building/crop nutrient management plan?**

☒ crop rotation	☐ incorporation of crop residue	☒ green manures
☒ cover crops	☐ compost	☐ manure
☒ mined lime	☒ mulch	☐ soil inoculants
☐ biodynamic preparations	☒ fertilizer materials or blends	☐ other (describe):

2. ***List all materials used or planned for use on your Materials List.**
   ☒ **All materials used or planned for use are listed on my Materials List.** ☐ **No materials are used.**

3. ***Describe your crop rotation plan(s), in general terms, including its main goals (soil organic matter; weed and pest management, nutrient management; erosion; biological diversity).** List the sequence and frequency of crops/plant families, cover crops, green manures or sod. If you use more than one basic rotation sequence, please describe each rotation you use. For perennial crops, describe management of ground cover, alley cropping, intercropping or hedgerows. Attach additional pages if necessary**.**

   Crop rotation consists of kale, collards, spinach and sweet potatoes.

   In the Benchmark Scenario (prior to adopting "low-till" practices), kale, collards is followed by sweet potatoes in the following year for a double crop (2-year rotation), and cover crops are not used. The Benchmark Scenario relies heavily on inter-row cultivation for weed control.

   In the Planned Scenario (i.e., the adoption of "low-till" practices), kale, collards, spinach and sweet potatoes are rotated in a 3-year sequence, with cover crops employed during the off-season. Specifically, a winter cover crop mixture (cereal rye + crimson clover) precedes kale, collards, spinach, which is terminated by crimping or mowing to create a weed-suppressing mulch, into which sweet potatoes are no-till planted. After wheat/oat, a summer cover crop mixture (sorghum-sudangrass + sunn hemp) is planted, which precedes the next winter cover crop.

4. ***Describe, and indicate, as applicable, the issues/goals you address with your crop rotation and soil management practices.**

☒ organic matter increase	☒ water availability	☒ water infiltration/drainage
☒ soil compaction or crusting	☒ soil structure	☒ water erosion
☐ wind erosion	☐ deficient nutrients	☐ excess nutrients
☐ salinity	☐ pH	☒ weed management
☐ pest management	☐ disease management	
☐ overall farm biodiversity	☐ other (describe):	

5. ***Describe, and indicate, as applicable, how you monitor the effectiveness of your rotation and soil management plan?**

☒ soil observation	☒ soil (nutrient) tests	☐ soil organic matter content
☒ crop observation	☒ crop yield comparison	☐ crop quality tests
☐ plant tissue tests	☐ microbiological tests	☐ other:

6. ***When and how often (i.e., daily, weekly, monthly, yearly, as needed) do you do each type of monitoring? What monitoring records do you keep?**

   Soil and crop observations: daily to weekly (visual); yield comparisons and soil testing: annually.

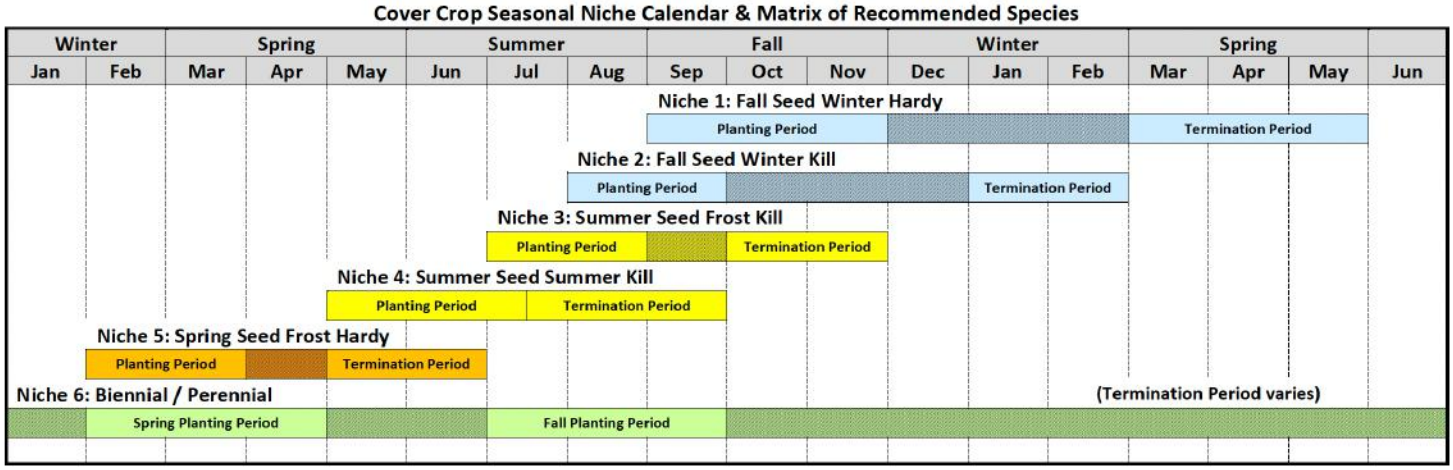
Update changes: Signature _____ Date _____

CPA 138 Conservation Plans can include many useful and informative charts, tables and graphs that can help inform growers of alternative production practices and enable them to make better management decisions while illustrating to NRCS that relevant data exists to necessitate the adoption and implementation of the proposed conservation practices. Examples for cover crop establishment are provided below.

Cover Crop Establishment

Source: NRCS PEG Cover Crop Establishment Specifications (340)

Cover Crop Seasonal Niche Calendar & Matrix of Recommended Species



Niche Name	Description	Functional Groups & Recommended Species		
		Grass	Broadleaf / Forb	Legume
1. Fall Seed Winter Hardy	Winterhardy cool-season annual planted in fall and terminated in spring.	annual ryegrass; small grains (barley, oat, wheat, triticale, rye)	rapeseed; forage turnip	red clover; crimson clover; Austrian winter pea; woollypod vetch; hairy vetch
2. Fall Seed Winter Kill	Fast-growing, frost-hardy annual seeded in early fall. Expected to freeze-kill mid-winter (at 15 to 20° F.)	spring oat	forage radish; mustard, phacelia	Canadian spring pea
3. Summer Seed Frost Kill	Frost-tender, warm-season annual planted in mid to late summer. Expected to winterkill at first frost.	sorghum-sudangrass; pearl millet; foxtail millet	buckwheat; black oil sunflower	forage soybean; cowpea; sunnhemp
4. Summer Seed Summer Kill	Frost-tender, warm-season annual seeded early summer. Terminated in time to plant back another crop in summer or fall.	sorghum-sudangrass; pearl millet; foxtail millet	buckwheat; black oil sunflower	forage soybean; cowpea; sunnhemp
5. Spring Seed Frost Hardy	Fast-growing, frost-hardy cool-season annual planted in late winter/early spring.	spring oat; winter (or spring) small grains (barley, wheat, triticale, rye)	forage radish; mustard; phacelia; rapeseed; forage turnip;	Canadian spring pea; Austrian winter pea; woolypod vetch; hairy vetch
6. Biennial / Perennial	Biennial or perennial, grown at least one summer, typically 18 months	tall fescue; orchardgrass		alfalfa; red clover; white clover; yellow blossom sweetclover

Cover Crop Species List A, Part 1: Recommended Fall-Seeded Species *(Seasonal Niches 1 & 2)*		
	Species	**Key Characteristics & Considerations**
Grasses	**Spring Oat** *Avena sativa*	Compare to winter oat below. Goal here is winterkill (Niche 2): select varieties accordingly, plant early for lush growth. Oat is least hardy small grain (SG), but may not winterkill in SE VA. Grows very fast in mild fall/spring. Much lower C:N, shorter-lived residue vs. typical SG. Needs good fertility. Good weed suppressor, moderate N scavenger, high forage quality. No vernalization required; may head out in fall but viable seed unlikely. Top nurse crop for fall legumes (use low rate). Mix with radish, peas. See also Niche 5.
	Annual Ryegrass *Lolium multiflorum* aka Italian Ryegrass	Popular cover in Corn Belt, much less in VA. Major weed in small grain (SG). Do not allow to set seed. Can be hard to kill with herbicides – timing is key. Dense fibrous root system, top soil conditioner, good weed suppresser, good N scavenger, top quality forage. Establishes well in tough conditions, but needs good fertility. Tolerates wet feet better than any SG. Not good in heat or drought. Winter-hardiness can vary – select cultivars accordingly. Shorter than SG, lower C:N, mixes well with crimson clover. See also Niche 5.
	Winter Oat *Avena sativa*	Compare to spring oat above. Goal here is overwintering (Niche 1): select varieties accordingly. Winter oat not common in VA. Unlikely to overwinter in western VA; best fit is Coastal Plain. Needs vernalization for heading. Planted early (like barley), but last SG to mature in spring. Good weed suppressor, ok N scavenger, high forage quality. Good rotation for other SG – not host for take-all disease. Good nurse crop. Compared to other SG: lowest biomass producer, slightly lower C:N, lower tolerance for extremes of dry and wet.
	Barley *Hordeum vulgare*	Widely used in VA. More winterhardy than oat, less than wheat/rye. Planted earlier in fall, matures earlier in spring than wheat. Best small grain (SG) for drought, heat, salty or alkaline soils. Quick growth & high biomass if fertility good. Good weed suppressor, N scavenger, forage. Retains feed quality after heading. Not for wet or acid soils. Good nurse for legumes. Timing, height match crimson clover, rapeseed. Poor choice for rolling. Not good for rotations with SG cash crops (will host same diseases and pests).
	Wheat *Triticum aestivum*	Versatile & widely used in VA. Compared to barley: planted later in fall, matures later in spring, tolerates wetness better (but not flooding), higher spring biomass potential (but requires high fertility). Very good N scavenger. Top quality forage – after multiple grazings can still produce high spring biomass or grain. Fine nurse crop for legumes. Mixes well with winter peas, hairy vetch. Shorter, slower to head means residue easier to manage than rye. Not good for rotations with SG cash crops (will host same diseases and pests).
	Triticale *Triticum secale*	A cross between rye and wheat, with characteristics intermediate between the two. High biomass yield potential is similar to wheat and rye. Matures later than rye, a little later than wheat. Plant height at heading shorter than rye. Therefore, spring residue is easier to manage than rye and (assuming same kill date) C:N ratio will be lower than rye. Triticale feed quality generally better than rye, but not as good as wheat (i.e., chop triticale for silage at boot stage).
	Rye *Secale cereale* aka Cereal Rye	Top winter cover for many purposes, most winterhardy, best on poor/acid soils. Top SG for N scavenging, biomass, seed suppression, tolerance of wet soils. Can plant later than any SG in fall, but matures early in spring – only barley is earlier. Rye alleleopathy inhibits weeds, but maybe also next crop if small-seeded. Height, biomass, high C:N at maturity can be overwhelming. Top choice for rolling. Potential weed if sets seed; caution in SG crop system. Good forage, but low quality after heading. Mix with vining vetch, pea.
Brassicas (B)	**Forage Radish (B)** *Raphanus sativus* aka Daikon; Daichon; Fodder Radish	Top Niche 2 (winterkill) option. May overwinter in SE VA. Early plant + mid seed rate = large lush plants, better winterkill. Late plant + high seed rate = smaller plants, more hardy. With good fertility, fastest-growing fall cover option. Top biomass, subsoiler, N scavenger, forage. Winterkilled residues disappear, N releases fast. Top weed suppressor (competition + alleleopathy). Good in mixes, caution not to out-compete companions. Different growth pattern if spring seed, see Niche 5. Can substitute oilseed radish.
	Mustard (B) **White/Yellow:** *Sinapis alba* **Brown/Indian:** *Brassica juncea* **Black:** *B. nigra (L.)*	Similar to other brassicas (see above, below), but best use in VA probably pest suppression, adding diversity to mixes. The brassica with most biotoxic compounds, best for biofumigation (requires soil incorporation, etc.). With fertility, potential for very fast fall growth, high biomass, good N scavenging. Not known for subsoiling, some varieties may not have taproot. Winter-hardiness, day length responses, other characteristics may vary by cultivar. Research & match varieties to your need. See also Niche 5.

continued on next page

continued from previous page

Cover Crop Species List A, Part 2: Recommended Fall-Seeded Species *(Seasonal Niches 1 & 2)*		
	Species	**Key Characteristics & Considerations**
Brassicas (B) / Forbs	**Phacelia** *Phacelia tanacetifolia* aka Lacy Phacelia	Unique crop with fernlike biomass. Fibrous shallow roots tops for soil aggregation. Not a brassica, adds diversity. Widely used in Europe. New to VA, info limited, seed costly. Fast growth in mild fall conditions, moderate biomass, residue not long-lasting. Winterkill expected in most of VA; may overwinter in SE VA; manage for lush growth to increase winterkill potential. Appears to have daylength response: in fall vegetative growth only; in spring goes to flower. Showy blue blooms tops for pollinators. See also Niche 5.
	Forage Turnip (B) *Brassica rapa var. rapa*	Similar to radish (above) or rapeseed (below), but less impressive taproot – instead makes bulb on surface. Good forage, probably fit best where cover will be grazed. With fertility, potential for fast fall growth, high biomass, good N scavenging. Big varietal differences possible, including major differences in bulb vs. top (leaf) ratios. Winter-hardiness, day length responses may vary also. Research cultivars to match your need. Big bulbs can be slow to break down, not ideal for subsequent planting or field operations. See also Niche 5.
	Rapeseed (B) *Brassica rapa* aka Canola; Rape	Top brassica option for Niche 1. Winter-hardy cousin to forage radish (see above), similar characteristics. Reliably winter-hardy if seeded on time, except maybe highest VA elevations. With fertility, gives biomass, forage, deep branched taproot, N scavenging, weed suppression. Spring flowers attract pollinators. Low cost to seed. Range of choices (canola for seed, hybrids for grazing, etc.), characteristics may differ. Good in mixes, but caution not to outcompete companions. Spring termination sometimes tricky. See also Niche 5.
Legumes	**Canadian Spring Pea** *Pisum sativum subsp. Arvense* *aka Yellow Field Pea*	Compare with winter pea below. Goal here is winterkill (Niche 2); rarely used this way in VA. Aim for lush growth – plant early! May not reliably winterkill in Coastal Plain. Select fastest growing spring types. Some contradictory info in literature about winterkill potential of peas. If fails to winterkill, easy to kill with other methods. Expect lower biomass & total N fixation compared to overwintered peas. Mixes well with spring oat, forage radish. Inoculate! Cross inoculates with vetch. See also Niche 5.
	Red Clover *Trifolium pratense*	Short-lived perennial, rarely used in this niche. Slow growing, must be seeded earlier, killed later than other annual legumes choices. Establishes readily, shade tolerant, very winter-hardy, inexpensive, resistant to some nematodes. Moderate N fixation. Best on good soils with high fertility; tolerates some wetness. For this niche, use multi-cut medium or one-cut mammoth varieties. Consider spring oat nurse crop or wheat/triticale companion. Inoculate! Cross inoculates with crimson or white clover. See also Niche 6.
	Crimson Clover *Trifolium incarnatum*	Popular in VA. May not reliably overwinter at very high elevations in VA. Earlier seeded, more fall growth, earlier spring bloom than hairy vetch. Short, upright growth habit. Good forage & weed suppressor. Good N fixer with slower residue breakdown & N release than vetch. Shade tolerant. Showy blooms, good for pollinators. Can reseed quickly & become weed. Host to some problem nematodes. Mixes esp. well with barley, annual ryegrass. Inoculate! Cross-inoculates with red or white clover.
	Austrian Winter Pea *Pisum sativum subsp. Arvense* aka Black Field Pea	Compare to spring pea above. Goal here is overwintering (Niche 1): select winterhardy accordingly, avoid planting too early or late. May not reliably overwinter at very high elevations in VA. Top N fixer, good biomass & forage. Succulent residues disappear & release N faster than vetch. Low reseeding & weed risk. Vining habit, mix with small grain to climb. Caution: Sclerotinia crown rot can take out whole field, risk increases with more peas in rotation. Inoculate seed! Cross inoculates with vetch. See also Niche 5.
	Woolypod Vetch *Vicia villosa ssp. dasycarpa* aka Lana Vetch	One of multiple vetch choices similar to hairy vetch (HV) – see below for HV description. Compared to HV, woollypod generally grows faster, produces more biomass, fixes more N, is less winterhardy. Likely to overwinter ok in eastern VA most years; limited info on winter survival in western VA. Caution: looks like HV, some vendors caution that not all seed sold as woollypod is woollypod. Common vetch (*Vicia sativa)* is possible substitute (increase seed rate 10%), might have less biomass potential. See also Niche 5.
	Hairy Vetch *Vicia villosa*	Reliable & widely used, but avoided by some due to weed concerns. Very winterhardy. Little fall growth, but fast vining spring growth makes it tops for N fixation, biomass. Residues release N fast. Good forage. Climbs well in mixes, also wraps up in equipment! Rye-vetch is top mix, or match with triticale, etc. Up to 20% of planted seed is hard, will germinate in future as weed. Host to some problem nematodes. Inoculate seed! Cross inoculates with peas. See above for other vetch types. See also Niche 5.

Establishment Specifications A: Fall-Seeded Cover Crops *(Seasonal Niches 1 & 2, Winter-Hardy & Winterkill)*

	Species (gray shading indicates Niche 2 – expected to winterkill)	Winterkill probability	Seeding rates (lb/ac, for monocultures)				Seed depth (inch)	Seeding dates								Approx. maturity MB = max. biomass; VS = viable seed *(use as general guideline only)*
			Base / default		Acceptable range			Mountain & Valley *(based on Oct 10 average first frost)*		Piedmont (PM) *(based on Oct 20 average first frost)*		Coastal Plain (CP) *(based on Nov 1 average first frost)*		Before or after avg first frost in fall *(DBFF or DAFF)*		
			Drill	Bcast + incorp	Drill	Bcast + incorp		Preferred	Possible	Preferred	Possible	Preferred	Possible	Preferred	Possible	
Grasses	Spring Oat	high to mid	80	110	65 to 125	100 to 165	0.5 to 1.5	Aug 1 to Aug 20	Jul 20 to Sep 5	Aug 10 to Sep 1	Aug 1 to Sep 15	Aug 20 to Sep 10	Aug 10 to Sep 25	70 to 50 DBFF	80 to 35 DBFF	Winterkills before VS
Grasses	Annual Ryegrass	low	15	25	10 to 20	20 to 30	0.25 to 0.5	Aug 10 to Sep 1	Aug 1 to Sept 20	Aug 20 to Sep 10	Aug 10 to Oct 1	Sep 1 to Sep 20	Aug 20 to Oct 10	60 to 40 DBFF	70 to 20 DBFF	Similar timing to barley
Grasses	Winter Oat *PM & CP only*	low to mid	80	110	65 to 125	100 to 165	0.5 to 1.5	not suited	not suited	Sep 10 to Sep 30	Sep 5 to Oct 5	Sep 20 to Oct 10	Sep 15 to Oct 15	40 to 20 DBFF	45 to 15 DBFF	Similar timing to wheat
Grasses	Barley	very low	100	140	50 to 150	75 to 200	0.75 to 2.0	Aug 10 to Sep 10	Aug 1 to Oct 10	Aug 20 to Sep 20	Aug 10 to Oct 20	Sep 1 to Oct 1	Aug 20 to Nov 1	60 to 30 DBFF	70 to 0 DBFF	Earlier to head than wheat
Grasses	Wheat	very low	120	160	60 to 180	90 to 240	0.5 to 1.5	Aug 25 to Sep 25	Aug 15 to Oct 25	Sep 5 to Oct 5	Aug 25 to Nov 5	Sep 15 to Oct 15	Sep 5 to Nov 15	45 to 15 DBFF	55 DBFF to 15 DAFF	Heads late Apr to early May
Grasses	Triticale	very low	110	145	60 to 170	90 to 225	0.75 to 2.0	Aug 25 to Sep 25	Aug 15 to Nov 1	Sep 5 to Oct 5	Aug 25 to Nov 10	Sep 15 to Oct 15	Sep 5 to Nov 20	45 to 15 DBFF	55 DBFF to 20 DAFF	Later to head than wheat
Grasses	Rye	very low	110	145	60 to 170	90 to 225	0.75 to 2.0	Aug 15 to Oct 1	Aug 5 to Nov 10	Aug 25 to Oct 10	Aug 15 to Nov 20	Sep 5 to Oct 20	Aug 25 to Dec 1	55 to 10 DBFF	65 DBFF to 30 DAFF	Earlier to head than barley
Brassicas (B) / Forbs	Forage Radish (B)	high	8	14	6 to 12	12 to 18	0.25 to 0.5	Aug 1 to Aug 20	Jul 10 to Sep 10	Aug 10 to Sep 1	Jul 20 to Sep 20	Aug 20 to Sep 10	Aug 1 to Oct 1	70 to 50 DBFF	90 to 30 DBFF	Winterkills before VS
Brassicas (B) / Forbs	Mustard (B)	high to mid	8	12	5 to 12	10 to 18	0.25 to 0.5	Aug 1 to Aug 20	Jul 10 to Sep 10	Aug 10 to Sep 1	Jul 20 to Sep 20	Aug 20 to Sep 10	Aug 1 to Oct 1	70 to 50 DBFF	90 to 30 DBFF	Winterkills before VS
Brassicas (B) / Forbs	Forage Turnip (B)	mid	5	10	2 to 8	8 to 12	0.25 to 0.5	Aug 1 to Aug 20	Jul 10 to Sep 10	Aug 10 to Sep 1	Jul 20 to Sep 20	Aug 20 to Sep 10	Aug 1 to Oct 1	70 to 50 DBFF	90 to 30 DBFF	Spring VS or winterkills
Brassicas (B) / Forbs	Phacelia	high to mid	8	12	7 to 12	10 to 14	0.25 to 0.5	Aug 1 to Aug 20	Jul 20 to Sep 1	Aug 10 to Sep 1	Aug 1 to Sep 10	Aug 20 to Sep 10	Aug 10 to Sep 20	70 to 50 DBFF	80 to 40 DBFF	Winterkills before VS
Brassicas (B) / Forbs	Rapeseed (B)	low	6	12	4 to 10	8 to 14	0.25 to 0.5	Aug 10 to Sep 1	Jul 20 to Sep 20	Aug 20 to Sep 10	Aug 1 to Oct 1	Sep 1 to Sep 20	Aug 10 to Oct 10	60 to 40 DBFF	80 to 20 DBFF	MB late Apr / early May
Legumes *(inoculate!)*	Canadian Spring Pea	high to mid	60	90	50 to 80	75 to 120	1.5 to 2.5	Aug 1 to Aug 20	Jul 20 to Sep 1	Aug 10 to Sep 1	Aug 1 to Sep 10	Aug 20 to Sep 10	Aug 10 to Sep 20	70 to 50 DBFF	80 to 40 DBFF	Winterkills before VS
Legumes *(inoculate!)*	Red Clover	very low	10	12	8 to 10	10 to 12	0.25 to 0.5	Aug 5 to Aug 25	Jul 25 to Sep 5	Aug 15 to Sep 5	Aug 5 to Sep 15	Aug 25 to Sep 15	Aug 15 to Sep 25	65 to 45 DBFF	75 to 35 DBFF	MB late May to mid June
Legumes *(inoculate!)*	Crimson Clover	low	15	25	15 to 20	20 to 30	0.25 to 0.5	Aug 10 to Sep 1	Aug 1 to Sept 20	Aug 20 to Sep 10	Aug 10 to Oct 1	Sep 1 to Sep 20	Aug 20 to Oct 10	60 to 40 DBFF	70 to 20 DBFF	MB late April to early May
Legumes *(inoculate!)*	Austrian Winter Pea	low	50	75	50 to 80	75 to 120	1.5 to 2.5	Aug 20 to Sep 10	Aug 10 to Oct 1	Sep 1 to Sep 20	Aug 20 to Oct 10	Sep 10 to Oct 1	Sep 1 to Oct 20	50 to 30 DBFF	60 to 10 DBFF	MB early to mid May
Legumes *(inoculate!)*	W.pod Vetch *PM & CP only*	low to mid	20	30	15 to 25	25 to 40	0.5 to 1.0	not suited	not suited	Sep 1 to Sep 20	Aug 20 to Oct 10	Sep 10 to Oct 1	Sep 1 to Oct 20	50 to 30 DBFF	60 to 10 DBFF	MB early to mid May
Legumes *(inoculate!)*	Hairy Vetch	very low	20	30	15 to 25	25 to 40	0.5 to 1.0	Aug 20 to Sep 10	Aug 1 to Oct 1	Sep 1 to Sep 20	Aug 10 to Oct 10	Sep 10 to Oct 1	Aug 20 to Oct 20	50 to 30 DBFF	70 to 10 DBFF	MB early to mid May

Cover Crop Species List B: Recommended Summer-Seeded Species *(Seasonal Niches 3 & 4)*		
	Species	**Key Characteristics & Considerations**
Grasses	**Sorghum-Sudangrass** *Sorghum bicolor x S. bicolor var. sudanese* aka Sudex, Sudax	Top grass choice. Heat-loving, fast-growing, 6-12 ft tall, big biomass potential, but needs lots soil N. Top weed suppressor thru competition, alleleopathy (caution on next crop if small seeded). Top subsoiler with thicker roots than most grasses. Good forage, but caution on prussic acid, nitrates. Improved forage types available, cultivars may vary widely. Regrows well after mow/graze. Huge biomass, reseeding potential can overwhelm: mow or kill timely! Mix with cowpea, sunnhemp. Can swap in forage sorghum or sudangrass.
	Pearl Millet *Pennisetum glaucum* aka Cattail Millet	Heat-loving, fast-growing, high-biomass option very similar to sorghum-sudangrass (see above). Compared to sorghum-sudangrass: slightly lower biomass potential; better on acid & droughty soils; less alleleopathy potential; less reputation for subsoiling; no prussic acid forage toxicity (but nitrates still a concern). Some contradictory info on pearl millet regrowth potential, but generally expected to regrow well if mow/graze high. Improved forage types available, cultivars may vary widely. Mix with cowpea, sunhemp.
	Foxtail Millet *Setaria italica* (aka German or Hay Millet)	Much shorter, finer-stemmed, lower-biomass option compared to sorghum-sudan & pearl (see above). Key difference: foxtail is reliably killed with single mowing. Also foxtail matures faster, not as good on weeds or drought. Some report foxtail grows little in 2nd half of summer due to photoperiod, other don't – maybe a cultivar issue? Mix with cowpeas, soybeans. Japanese and browntop millet are similar, but might not mow kill as well and may mature faster/reseed more easily; substitute these species if foxtail not available.
Forbs	**Black Oilseed Sunflower** *Helianthus annus*	Rarely used in VA, primarily for adding diversity to mixes. Blooms very attractive to people, pollinators, wildlife. Very low cost seed. Deep branched taproot, good reputation for pulling up nutrients (but not necessarily subsoiling). Good heat & drought tolerance once established. OK weed suppressor. Seems to do well in mixes – some report it grows tall in tall mix, short in short mix. Varying reports on cold tolerance; most sources say more cold tolerant than other summer covers, but still winterkills at 28° F.
	Buckwheat *Fagopyrum esculentum*	Popular summer cover. Top weed suppressor due to very fast growth (not alleleopathy). Blooms & extra-floral nectaries tops for pollinators, beneficials. High risk of reseeding: terminate or mow within 7 to 10 days of first bloom. Matures faster than all other covers – if reseeding a concern, don't grow in mixes. Needs warm conditions, but very low tolerance to drought or high heat. Fine root system good for topsoil conditioning, but not subsoiling. Easy to kill. Books say excellent for unlocking soil phosphorous (P).
Legumes	**Forage Soybean** *Glycine max*	Similar to cowpea (see below) for cover crop use. Compared to cowpea: more tolerant of cool weather, wet soils; less tolerant of drought, pests, poor soil fertility. Good N fixation, biomass, and forage potential. Many varieties available; use late-maturing or forage cultivars for high biomass. Bushy growth habit, mixes better with short grasses like foxtail. Not good rotation for grain systems with cash crop soybeans. Low reseeding & weed risk. Inoculate! Does not cross inoculate with other legumes.
	Cowpea *Vigna unguiculata* aka Crowder or Southern or Blackeyed Pea	Top summer legume. Very heat & drought tolerant once established, deep taproot, tolerates low fertility. Grows fast, good biomass & forage, high N fixation potential, good weed suppressor. Extrafloral nectaries great for beneficial insects. Some pest nematode suppression. Many cultivars; select forage or cover types. Some shade tolerance = good for mixes. Use bush types for short mixes, vine for tall mixes. Needs heat, caution in VA mountains. Low reseeding & weed risk. Inoculate! Cross-inoculates with peanut, sunnhemp.
	Sunnhemp *Crotolaria juncea L.* aka Sunn Hemp	Tall tropical legume new to VA. Grows well in late summer, vendors encourage using it for winterkill (Niche 4). Reported to fix lots of N in short time. Spindly growth habit with narrow leaves = better choice for mixes than monoculture. Becomes very stemmy as matures. Low forage potential. Interesting yellow blooms; very low risk of reseeding and becoming weed. Mix with sudex, pearl millet, sunflower. Inoculate seed! Cross-inoculates with cowpea, sunnhemp.

Cover Crop Establishment Specifications B: Summer-Seeded Species *(Seasonal Niches 3 & 4)**

	Species	Seeding rates (lb/ac, for monocultures)				Seed depth (inch)	Seeding dates								Probability crop regrows after mowing	Approx. maturity* MB = max. biomass; VS = viable seed *(use as general guideline only)*
		Base / default		Acceptable range			Mountain & Valley *(based on May 1 last frost, Oct 10 first frost)*		Piedmont *(based on Apr 20 last frost, Oct 20 first frost)*		Coastal Plain *(based on Apr 10 last frost, Nov 1 first frost)*		Days after last spring frost *(DALF)* & before first fall frost *(DBFF)*			
		Drill	Bcast+ incorp	Drill	Bcast+ incorp		Preferred	Accept-able	Preferred	Accept-able	Preferred	Accept-able	Preferred	Accept-able		
Grasses	Sorghum-Sudangrass	35	45	20 to 50	30 to 70	0.5 to 1.0	Jun 20 to Aug 10	Jun 1 to Aug 25	Jun 10 to Aug 20	May 20 to Sep 5	Jun 1 to Sep 1	May 10 to Sep 15	50 DALF to 60 DBFF	30 DALF to 45 DBFF	very high	MB: 45 to 65 days after plant (DAP)
Grasses	Pearl Millet	20	30	10 to 30	20 to 40	0.5 to 1.0	Jun 20 to Aug 10	Jun 1 to Aug 25	Jun 10 to Aug 20	May 20 to Sep 5	Jun 1 to Sep 1	May 10 to Sep 15	50 DALF to 60 DBFF	30 DALF to 45 DBFF	high	MB: 45 to 70 days after plant (DAP)
Grasses	Foxtail Millet	20	30	15 to 30	20 to 40	0.25 to 0.75	Jun 20 to Jul 20	Jun 1 to Aug 20	Jun 10 to Aug 1	May 20 to Sep 1	Jun 1 to Aug 10	May 10 to Sep 10	50 DALF to 80 DBFF	30 DALF to 50 DBFF	very low	MB: 40 to 60 VS: 60 to 75 DAP
Forbs	Black Oil Sunflower	5	10	3 to 6	6 to 12	0.75 to 1.75	May 20 to July 25	May 10 to Aug 10	May 10 to Aug 5	May 1 to Aug 20	May 1 to Aug 15	Apr 20 to Sep 1	20 DALF to 75 DBFF	10 DALF to 60 DBFF	very low	MB: 80 DAP VS: 120 DAP
Forbs	Buckwheat	60	80	40 to 100	60 to 120	0.5 to 1.5	May 25 to Aug 10	May 15 to Aug 25	May 15 to Aug 20	May 5 to Sep 5	May 5 to Sep 1	Apr 25 to Sep 15	25 DALF to 60 DBFF	15 DALF to 45 DBFF	low	MB as fast as 30 DAP; VS as fast as 45 DAP
Legumes	Forage Soybean	60	90	40 to 100	60 to 130	0.75 to 1.5	Jun 10 to July 15	May 20 to Aug 1	Jun 1 to July 25	May 10 to Aug 10	May 20 to Aug 5	May 1 to Aug 20	40 DALF to 85 DBFF	20 DALF to 70 DBFF	low	MB: 50 to 75 days after plant (DAP)
Legumes	Cowpea	50	80	30 to 90	50 to 120	1.0 to 1.5	Jun 20 to Jul 25	Jun 1 to Aug 10	Jun 10 to Aug 5	May 20 to Aug 20	Jun 1 to Aug 15	May 10 to Sep 1	50 DALF to 75 DBFF	30 DALF to 60 DBFF	low	MB: 50 to 90 VS: 90 to 120 DAP
Legumes	Sunnhemp	20	30	15 to 45	25 to 60	0.5 to 1.0	Jun 20 to Jul 25	Jun 1 to Aug 10	Jun 10 to Aug 5	May 20 to Aug 20	Jun 1 to Aug 15	May 10 to Sep 1	50 DALF to 75 DBFF	30 DALF to 60 DBFF	very low	MB: 90 DAP Season too short for VS

*Use maturity information to estimate whether cover will reach maturity prior to frost. If not, use timely mowing to retard seed set and/or terminate using other methods.

Cover Crop Species List C: Recommended Spring-Seeded Frost-Hardy Species *(Seasonal Niche 5)*		
	Species	**Key Characteristics & Considerations**
Grasses	**Spring Oat** *Avena sativa*	See fall-seeded species table for details on oat. Top spring small grain (SG) choice. Select spring types that head/ seed without overwintering. At maturity, lower C:N than most SGs. At low rate, a good nurse crop option for spring seeded perennials. Oat/pea is classic mix. Use same types for Niche 2 (fall seed winterkill).
	Small Grains **(barley, wheat, triticale, rye)**	See fall-seeded species table for details on small grain (SG). Winter SG typical in VA – needs overwintering for heading/seed set. Winter SG seeded in spring might not vernalize; if not, stays short, no stalk. Might be good or bad – depends on purpose. If stems/residue needed, seed winter types early or use spring oat/SG.
	Annual Ryegrass *Lolium multiflorum*	See fall-seeded species table for details on ryegrass. Likely to provide good cover if seeded in spring; total biomass production, if and when will start reproductive phase, etc. less certain. Control before seed set. If still vegetative, will fade out fast in heat of summer.
Brassicas (B) / Forbs	**Forage Radish (B)** *Raphanus sativus*	See fall-seeded species table for details on radish. For typical VA varieties, spring seeding gives very different result from fall seeding. Much less root and top growth, bolts and flowers very quickly. Attractive white flowers. Thus spring use primarily to add fast bloom, diversity to mixes. Some varieties may differ.
	Mustard (B) *Sinapis alba; Brassica juncea; B. nigra (L.)*	See fall-seeded species tables for details on mustard. Spring growth pattern may vary by cultivar; research & match varieties to meet needs. Initial observations in VA indicate spring results similar to radish – much less biomass, bolts & flowers very fast. Thus spring use mainly for adding diversity, fast blooms in mixes.
	Phacelia *Phacelia tanacetifolia*	See fall-seeded species tables for details on phacelia. Initial observations indicate only spring seeding produces blooms; biomass is modest, but longer growth period before flowering than radish, mustard. Showy blue blooms very good for pollinators, probably key purpose for growing this in spring.
	Forage Turnip **(B)** *Brassica rapa var. rapa*	See fall-seeded species tables for details on turnip. Spring seeding likely provides similar results to radish and mustard (see above) – limited biomass, fast flowering. Spring results may be highly cultivar-specific. Research & match varieties to your needs.
	Rapeseed (B) *Brassica rapa* aka Canola; Rape	See fall-seeded species tables for details on rapeseed. Like small grain, winter & spring types are available. Initial observations with spring-seeded winter rape suggest more growth than radish or mustards before flowering, but still less biomass than if fall seeded. May vary by cultivar; research & match seed to needs.
Legumes	**Canadian Spring Pea** *Pisum sativum*	See fall-seeded species tables for details on spring peas. Top legume choice for early spring seeding. Select fastest-growing spring types. Expect lower biomass & total N fixation compared to overwintered peas. Mixes well with spring oat. Inoculate! Cross inoculates with vetch. Use same types as for See also Niche 2.
	Austrian Winter Pea *Pisum sativum*	See fall-seeded species tables for details on winter peas. Expect slightly slower growth and less biomass than with spring pea (see above), but typically similar results. Much lower total biomass potential if spring seeded compared to standard fall seeding. Inoculate! Cross inoculates with vetch. See also Niche 1.
	Woollypod Vetch *Vicia villosa ssp. dasycarpa*	See fall-seeded species tables for details on woollypod. 2nd choice behind peas for short-term spring N fixation. One of multiple specialty vetches similar to hairy vetch (HV). Likely to be less winter-hardy, but faster growth, more biomass than spring-seeded HV. Common vetch (*Vicia sativa*) option is larger seeded, increase rate by 25%. Rare in VA are purple vetch and chickling vetch – likely low winterhardiness, but maybe better spring options. Research & select seed to meet needs. Inocluate! Cross-inoculates with pea.
	Hairy Vetch *Vicia villosa*	See fall-seeded species tables for details on hairy vetch. May not grow as well spring seeded as woollypod or other specialty vetches (see above), but readily available. Inoculate! Cross-inoculates with peas.

Cover Crop Establishment Specifications C: Spring-Seeded, Frost-Hardy Species *(Seasonal Niche 5)*

	Species	Seeding rates (lb/ac, for monocultures)				Seed depth (inch)	Seeding dates								Approx. maturity MB = max. biomass; VS = viable seed *(use as general guideline only)*
		Base / default		Acceptable range			Mountain & Valley *(based on May 1 average last frost)*		Piedmont *(based on Apr 20 average last frost)*		Coastal Plain *(based on Apr 10 average last frost)*		Days before average last spring frost *(DBLF)*		
		Drill	Bcast + incorp	Drill	Bcast + incorp		Preferred	Accept-able	Preferred	Accept-able	Preferred	Accept-able	Preferred	Possible	
--- Grasses ---	Spring Oat	80	110	65 to 125	100 to 165	0.5 to 1.5	Mar 15 to Apr 5	Mar 5 to Apr 20	Mar 5 to Mar 25	Feb 25 to Apr 10	Feb 25 to Mar 15	Feb 15 to Apr 1	45 to 25 DBLF	55 to 10 DBLF	MB 60 to 75 days after planting (DAP)
	Barley, Wheat, Triticale, Rye	Obtain seeding rate and depth for selected small grains from Establishment Specs A (fall seeded)					Mar 15 to Apr 5	Mar 5 to Apr 20	Mar 5 to Mar 25	Feb 25 to Apr 10	Feb 25 to Mar 15	Feb 15 to Apr 1	45 to 25 DBLF	55 to 10 DBLF	Winter types should head out if use preferred dates
	Annual Ryegrass	15	25	10 to 20	20 to 30	0.25 to 0.5	Apr 1 to Apr 20	Mar 20 to May 1	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	30 to 10 DBLF	40 to 0 DBLF	Uncertain; consult local experts
---- Brassicas (B) / Forbs ----	Forage Radish (B)	8	14	6 to 12	12 to 18	0.25 to 0.5	Apr 1 to Apr 20	Mar 20 to May 1	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	30 to 10 DBLF	40 to 0 DBLF	MB 50 to 60 DAP; little root; quick to bloom quick to bloom
	Mustard (B)	8	12	5 to 12	10 to 18	0.25 to 0.5	Apr 1 to Apr 20	Mar 20 to May 1	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	30 to 10 DBLF	40 to 0 DBLF	MB 50 to 60 DAP; quick to bloom; cultivars vary
	Forage Turnip (B)	5	10	2 to 8	8 to 12	0.25 to 0.5	Apr 1 to Apr 20	Mar 20 to May 1	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	30 to 10 DBLF	40 to 0 DBLF	Uncertain; cultivars may vary
	Phacelia	8	12	7 to 12	10 to 14	0.25 to 0.5	Apr 1 to Apr 20	Mar 20 to May 1	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	30 to 10 DBLF	40 to 0 DBLF	MB 60 to 80 DAP; very attractive blue blooms
	Rapeseed (B)	6	12	4 to 10	8 to 14	0.25 to 0.5	Apr 1 to Apr 20	Mar 20 to May 1	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	30 to 10 DBLF	40 to 0 DBLF	MB 60 to 80 DAP; slower to bolt and bloom than radish or
Legumes *(inoculate!)*	Canadian Spring Pea	60	90	50 to 80	75 to 120	1.5 to 2.5	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	Mar 1 to Mar 20	Feb 20 to Apr 1	40 to 20 DBLF	50 to 10 DBLF	MB 60 to 90 days after planting (DAP)
	Austrian Winter Pea	50	75	50 to 80	75 to 120	1.5 to 2.5	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	Mar 1 to Mar 20	Feb 20 to Apr 1	40 to 20 DBLF	50 to 10 DBLF	MB 60 to 90 days after planting (DAP)
	Woolypod Vetch	20	30	15 to 25	25 to 40	0.5 to 1.0	Apr 1 to Apr 20	Mar 20 to May 1	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	30 to 10 DBLF	40 to 0 DBLF	MB 60 to 90 days after planting (DAP)
	Hairy Vetch	20	30	15 to 25	25 to 40	0.5 to 1.0	Apr 1 to Apr 20	Mar 20 to May 1	Mar 20 to Apr 10	Mar 10 to Apr 20	Mar 10 to Apr 1	Mar 1 to Apr 10	30 to 10 DBLF	40 to 0 DBLF	MB 60 to 90 days after planting (DAP)

Cover Crop Species List D: Recommended Biennial/Perennial Species *(Seasonal Niche 6)*		
Species		**Key Characteristics & Considerations**
Grasses	**Tall Fescue** *Festuca arundinacea*	Most competitive, persistent perennial cool-season grass in VA, especially in warmer regions. Top choice for low-maintenance cover, erosion control, organic matter building. Low cost; deep roots; high biomass esp. in spring/fall with ample soil N; tolerant of drought, wet soils, poor soils. Most VA fescue infected with endophyte fungus – lowers forage value, but plants more durable. Forage and turf types available. Improved, endophyte-free cultivars are better forage, less persistant stands. Hay, graze, or clip to minimize seed set, keep stand vegetative. Mow high to maintain root reserves. If managed like hay, mix with red clover, alfalfa. If kept low with mowing (turf types) or grazing, mix with white clover. Best if fall-seeded, but spring works. Consider seeding with small grain that will be harvested/mowed to "release" perennial.
	Orchardgrass *Dactylis glomerata*	Widely-adapted perennial cool-season grass in VA, esp. in cooler regions. Higher forage quality than tall fescue (see above), but not as tolerant of heat, drought, heavy grazing, low mowing, poor soils. Tops for forage, biomass production, erosion control, soil building on with good fertility & management. Not long-lived in warmer regions of VA, but can fill perennial cover crop window of 1 to 3 summers anywhere in state. Hay, graze, or clip to minimize seed set, keep stand vegetative. Mow high/rotationally graze to maintain root reserves. Mix with red clover, alfalfa. Fall seeding is best, esp. in eastern VA. Consider seeding with small grain nurse crop that will be harvested/mowed off to "release" perennial understory.
Legumes	**Alfalfa** *Medicago sativa*	Top legume hay crop, very deep taproot, top N fixer. Expensive, best for longer windows (2 to 4 summers) and double-duty as forage & soil builder. Needs high soil pH, good fertility; not for wet soils. Super deep roots = drought tolerant. Dormant in winter; mix with hay-type grass (orchardgrass, etc.) for winter cover and to moderate C:N ratio at termination. Cut for hay or clip high to keep vegetative and maintain stand. For hay, 1st cut at bud stage, next cuts every 30-40 days (late bud to ¼ bloom), last cut in fall in time for 8" regrowth. Consider seeding with nurse of spring oats at low rate or small grains that will be harvested/mowed off to "release" perennial understory. Inoculate! Cross-inoculates with sweetclover.
	Red Clover *Trifolium pratense*	Short-lived perennial, often lasts two years. Multi-cut "medium" types best for this niche. Upright plant often used for hay, very winter-hardy, inexpensive, resists some nematodes, good taproot. Top N fixation, forage, blooms. Needs good soils & fertility; tolerates some wetness. Keep hayed (¼-⅓ bloom) or clipped high to avoid seed set, keep stand vegetative. Mix with grasses like orchardgrass or fescue to moderate C:N ratio at termination. Consider seeding with spring oat at low or small grain that will be harvested/mowed to "release" clover understory. Inoculate! Cross inoculates with crimson or white clover. See also Niche 1.
	White Clover *Trifolium repens* aka Intermediate, Common, or Dutch White Clover	Low-growing perennial, most tolerant clover for shade, traffic, tight mowing/grazing, acid/poor soil. As cover crop, a top use is as mowed living mulch in walkways, alleyways, understory. Shallow roots, spreads by lateral-growing stolons. Good N fixer, pollinator-friendly blooms. Persists and competes best if mowed low; can last many years. Two other types available: "wild white" is shorter; Ladino white is taller (for orchardgrass-type pastures). To make a mix with common white clover, use low-growing, mowing-tolerant fescue or other shorter grasses. Inoculate! Cross inoculates with crimson or red clover.
	Yellow Blossom Sweetclover *Melilotus officinalis*	Biennial known for deep subsoiling, N fixation. Prefers mild conditions, but most drought-tolerant legume once established. Note good on wet soil. Historically a top green manure. Now rarely grown, so practical info hard to find in VA – do your research and start small! Suggested use: plant early spring, growth 1st season is mostly underground, should not flower, avoid mowing. After overwintering, 2nd-season growth is above-ground – high biomass & N fixation, sweet-smelling blooms. Hard-seeded, some planted seed may germinate in future seasons. Lots of small seed, control before they are viable. Inoculate! Cross-inoculates with alfalfa. Option: Hubam annual white sweetclover; also seeded in spring, but doesn't overwinter.

Cover Crop Establishment Specifications D: Biennial/Perennial Species *(Seasonal Niche 6)*

	Species	Seeding rates (lb/ac, for monocultures)				Seed depth (inch)	Seeding dates							
		Base or default		Acceptable range			Mountain & Valley *(based on May 1 last avg. frost, Oct 10 first avg. frost)*		Piedmont *(based on Apr 20 last avg. frost, Oct 20 first avg. frost)*		Coastal Plain *(based on Apr 10 last avg. frost, Nov 1 first avg. frost)*		Days before first fall frost *(DBFF)*, days before last spring frost *(DBLF)*	
		Drill	Bcast + incorp	Drill	Bcast + incorp		Preferred	Possible	Preferred	Possible	Preferred	Possible	Preferred	Possible
Grasses	Tall fescue	20	25	15 to 20	20 to 25	0.25 to 0.50	Fall: Aug 15 to Sep 10	Fall: Aug 1 to Oct 5	Fall: Aug 25 to Sep 20	Fall: Aug 10 to Oct 15	Fall: Sep 5 to Oct 1	Fall: Aug 20 to Oct 25	Fall: 55 to 30 DBFF	Fall: 70 to 5 DBFF
							Spring: Mar 15 to Apr 5	Spring: Mar 1 to Apr 25	Spring: Mar 5 to Mar 25	Spring: Feb 20 to Apr 15	Spring: Feb 25 to Mar 15	Spring: Feb 10 to Apr 5	Spring: 45 to 25 DBLF	Spring: 60 to 5 DBLF
	Orchardgrass	12	16	8 to 15	12 to 20	0.25 to 0.50	Fall: Aug 15 to Sep 5	Fall: Aug 5 to Oct 1	Fall: Aug 25 to Sep 15	Fall: Aug 5 to Oct 10	Fall only: Sep 5 to Sep 25	Fall: Aug 25 to Oct 20	Fall: 55 to 35 DBFF	Fall: 65 to 10 DBFF
							Spring: Mar 15 to Apr 1	Spring: Mar 5 to Apr 15	Spring: Mar 5 to Mar 20	Spring: Feb 25 to Apr 5	NA	Spring: Feb 15 to Mar 25	Spring: 40 to 30 DBLF *(not C.Plain)*	Spring: 55 to 15 DBLF
Legumes *(inoculate!)*	Alfalfa	20	25	15 to 20	20 to 25	0.25 to 0.50	Fall: Aug 10 to Sep 1	Fall: Aug 1 to Sep 20	Fall: Aug 20 to Sep 10	Fall: Aug 10 to Oct 1	Fall: Sep 1 to Sep 20	Fall: Aug 20 to Oct 10	Fall: 60 to 40 DBFF	Fall: 70 to 20 DBFF
							Spring: Mar 20 to Apr 10	Spring: Mar 1 to Apr 20	Spring: Mar 10 to Apr 1	Spring: Mar 1 to Apr 10	Spring: Mar 1 to Mar 20	Spring: Feb 20 to Apr 1	Spring: 40 to 20 DBLF	Spring: 50 to 10 DBLF
	Red clover	10	12	8 to 12	10 to 15	0.25 to 0.50	Fall: Aug 10 to Sep 1	Fall: Aug 1 to Sep 20	Fall: Aug 20 to Sep 10	Fall: Aug 10 to Oct 1	Fall: Sep 1 to Sep 20	Fall: Aug 20 to Oct 10	Fall: 60 to 40 DBFF	Fall: 70 to 20 DBFF
							Spring: Mar 20 to Apr 10	Spring: Mar 1 to Apr 20	Spring: Mar 10 to Apr 1	Spring: Mar 1 to Apr 10	Spring: Mar 1 to Mar 20	Spring: Feb 20 to Apr 1	Spring: 40 to 20 DBLF	Spring: 50 to 10 DBLF
	White clover	5	10	3 to 9	5 to 14	0.25 to 0.50	Fall: Aug 10 to Sep 1	Fall: Aug 1 to Sep 20	Fall: Aug 20 to Sep 10	Fall: Aug 10 to Oct 1	Fall: Sep 1 to Sep 20	Fall: Aug 20 to Oct 10	Fall: 60 to 40 DBFF	Fall: 70 to 20 DBFF
							Spring: Mar 20 to Apr 10	Spring: Mar 1 to Apr 20	Spring: Mar 10 to Apr 1	Spring: Mar 1 to Apr 10	Spring: Mar 1 to Mar 20	Spring: Feb 20 to Apr 1	Spring: 40 to 20 DBLF	Spring: 50 to 10 DBLF
	Yellow blossom sweetclover	10	15	6 to 12	10 to 20	0.25 to 0.50	NA	NA	NA	NA	NA	NA	NA	NA
							Spring: Apr 1 to Apr 20	Spring: Mar 20 to May 1	Spring: Mar 20 to Apr 10	Spring: Mar 10 to Apr 20	Spring: Mar 10 to Apr 1	Spring: Mar 1 to Apr 10	Spring: 30 to 10 DBLF	Spring: 40 to 0 DBLF